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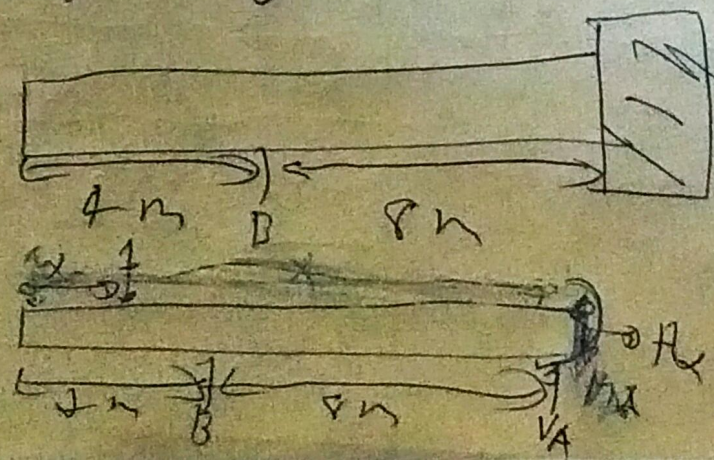
Computational Exercise: Copied No. 2 - 2 from
Lins

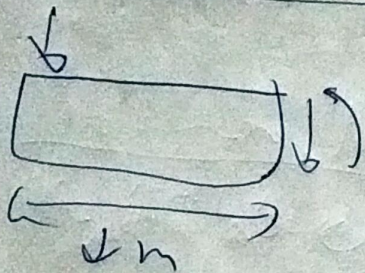
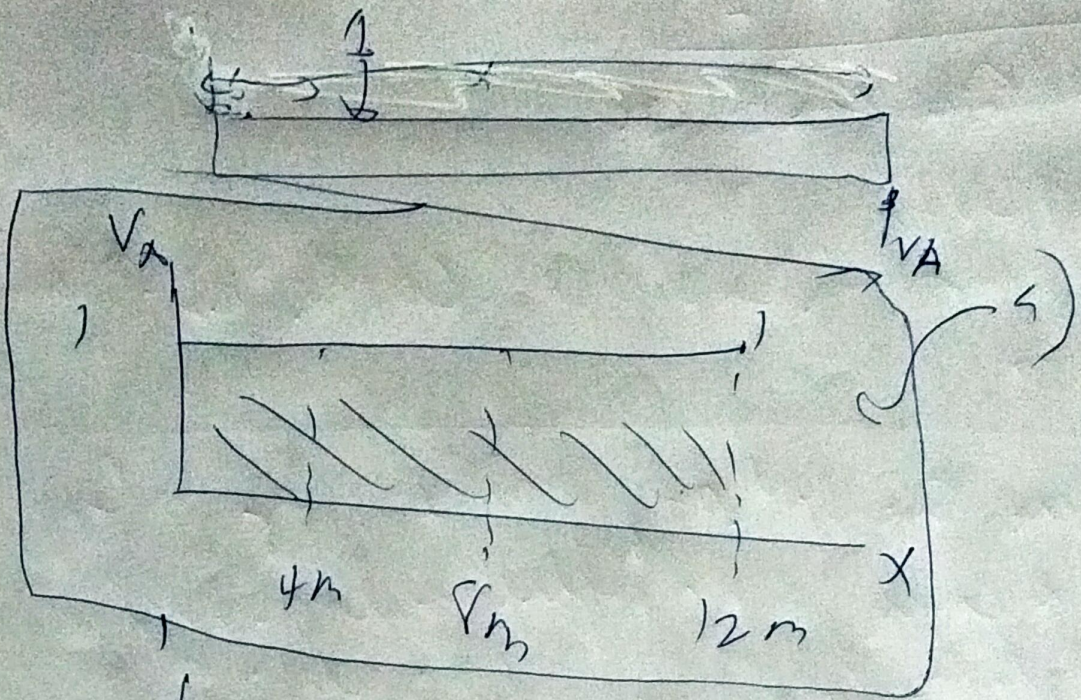
Solve the following problems by applying
the concepts of influence lines. Provide
complete solution and highlight the final
answers.

Problem No 1

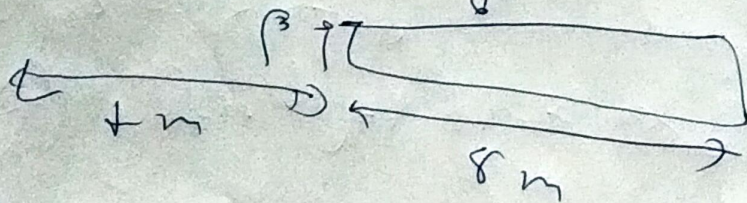
For the continuous beam shown, trace
the influence lines for the following:

- Vertical reaction at A
- Shear at B
- Bending moment at B

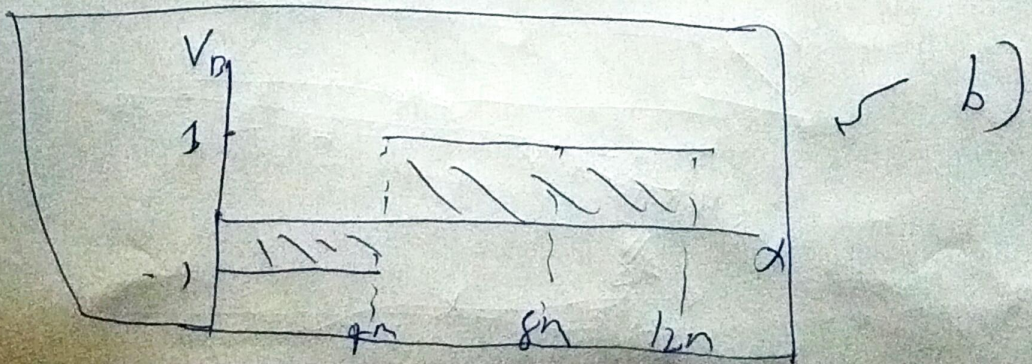


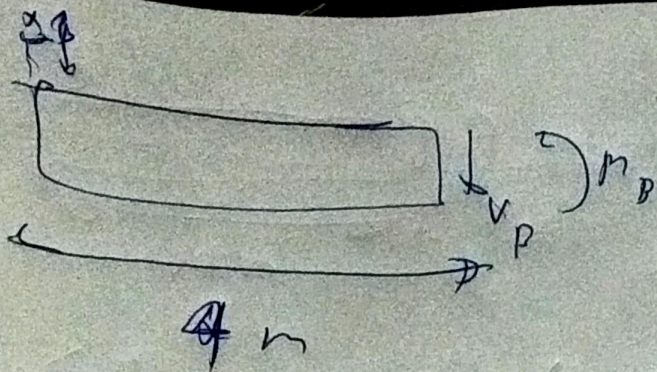


$$\sum \mathcal{M}_y = 0! \quad -1 - V_B = 0 \quad \therefore V_B = -1$$

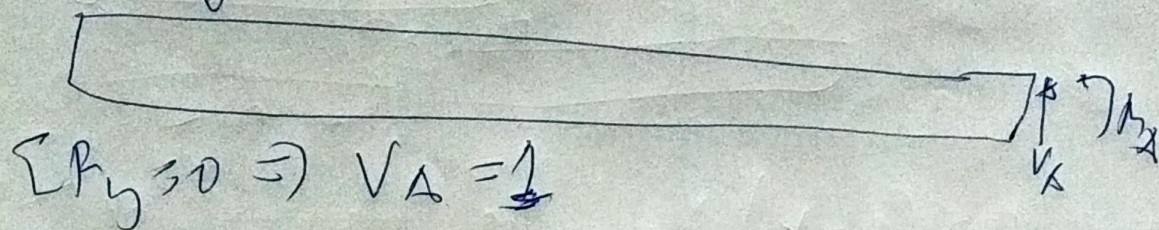
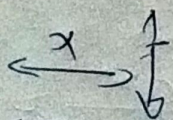


$$\sum \mathcal{M}_y = 0! \quad -1 + V_B = 0 \quad \therefore V_B = 1$$

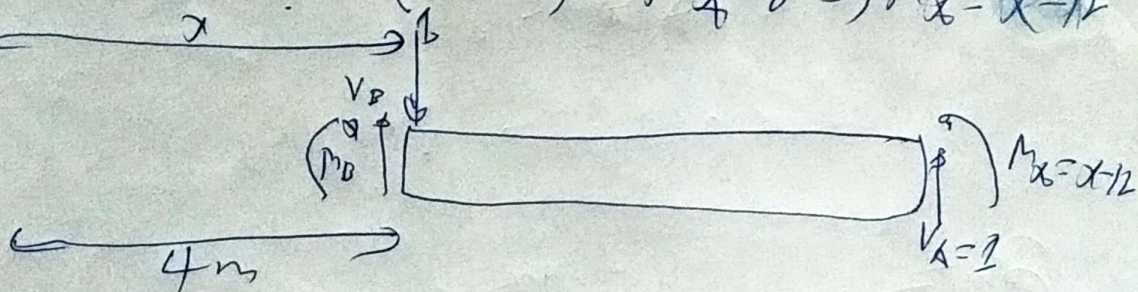




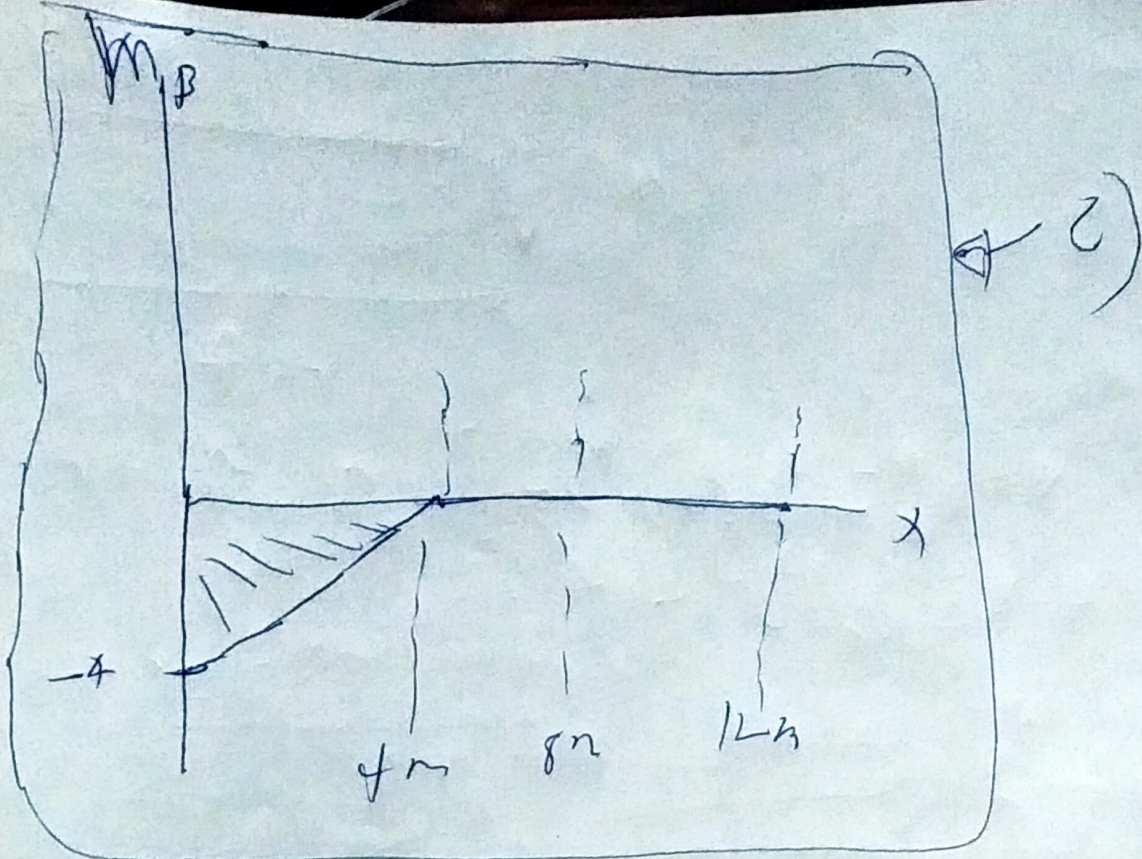
$$\begin{aligned} \sum M_B = 0: & -1(4-x) - M_B = 0 \\ \therefore M_B &= -(4-x) = x-4 \end{aligned}$$



$$\begin{aligned} \sum M_A = 0: & -1(12-x) - M_K = 0 \Rightarrow M_K = x-12 \end{aligned}$$



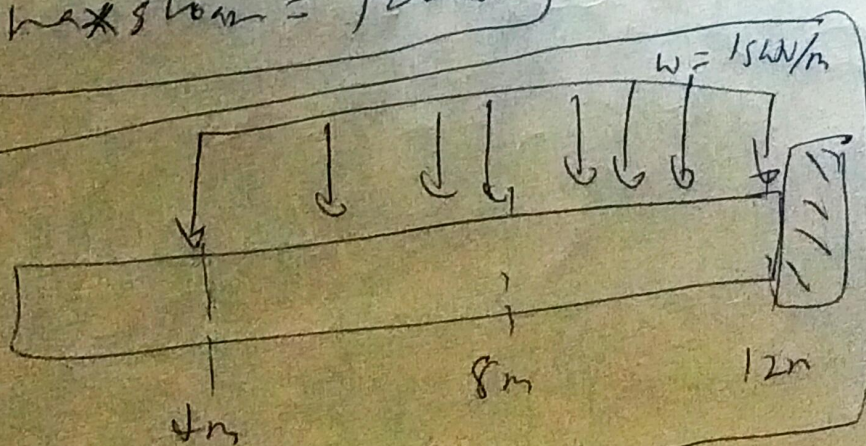
$$\begin{aligned} \sum M_B = 0: & M_B + 1(x-4) - 1(8) - (x-12) = 0 \\ M_B + x - 4 - 8 - x + 12 &= 0 \Rightarrow M_B = 0 \end{aligned}$$



What is the maximum shear at B due to a uniform live load with intensity $w = 15 \text{ kN/m}$?
 Show using a sketch where to apply the load to obtain the maximum value

$$V_{B \max} = 15 (8) = 120 \text{ kN}$$

$$\text{max shear} = 120 \text{ kN}$$



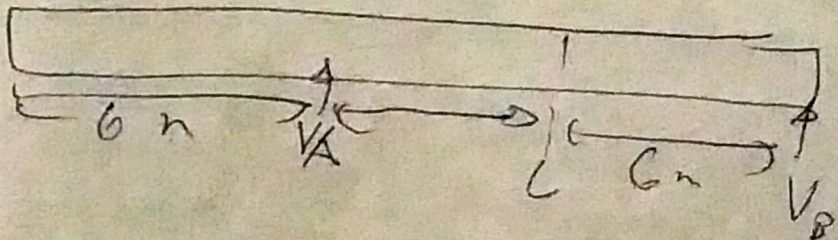
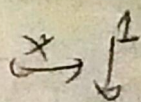
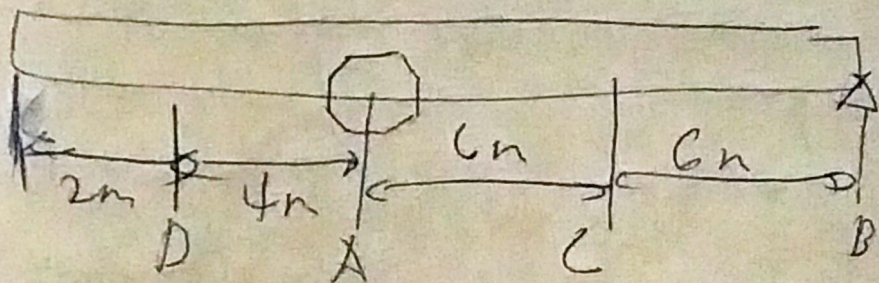
Problem No. 2

For the single beam with overhanging span, draw the influence line for the following:

a) Vertical reaction at A

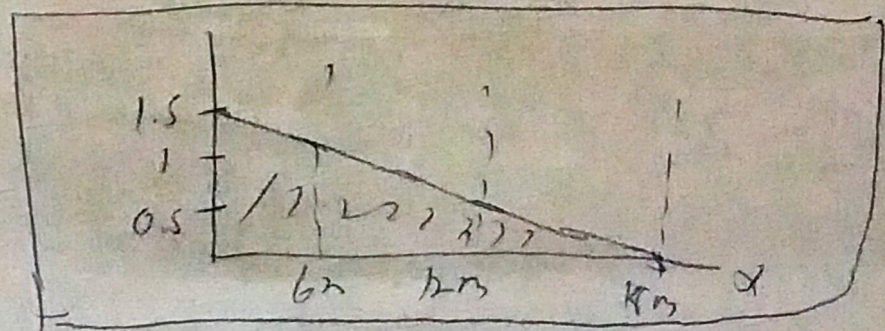
b) Shear at C

c) Moment at C



$$\sum \mathcal{M}_B = 0: -1(18-x) + V_A(12) = 0 \quad V_A(12) = 18-x$$

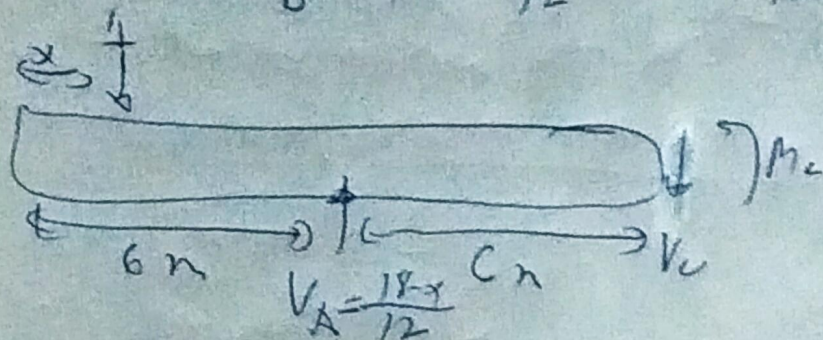
$$V_A = \frac{18-x}{12}$$



5.)

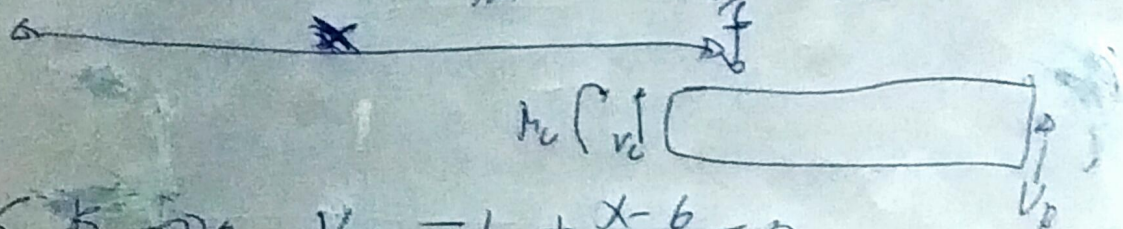
$$\sum R_y = 0: -1 + \frac{18-x}{12} + V_D = 0$$

$$V_D = 1 - \frac{18-x}{12} = -\frac{6-x}{12} = \frac{x-6}{12}$$



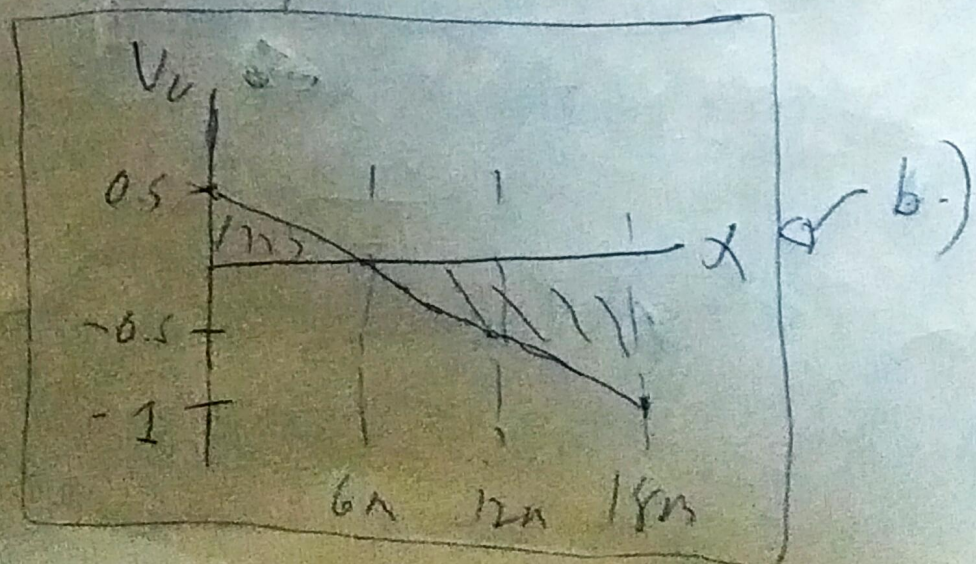
$$\sum R_y = 0: -1 + \frac{18-x}{12} - V_U = 0$$

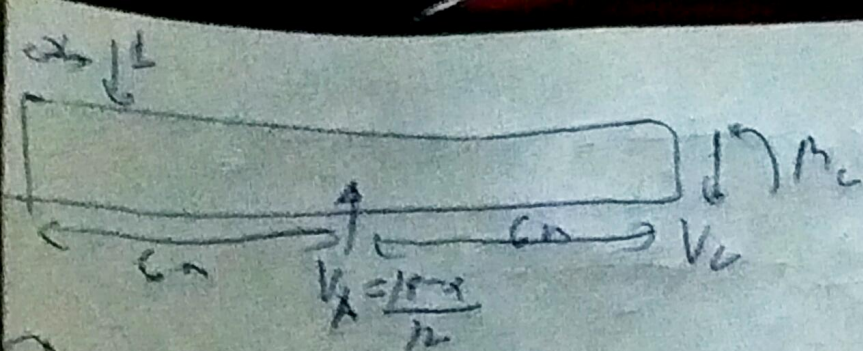
$$V_U = -1 + \frac{18-x}{12} \therefore V_U = \frac{6-x}{12}$$



$$\sum R_y = 0: V_U - 1 + \frac{x-6}{12} = 0$$

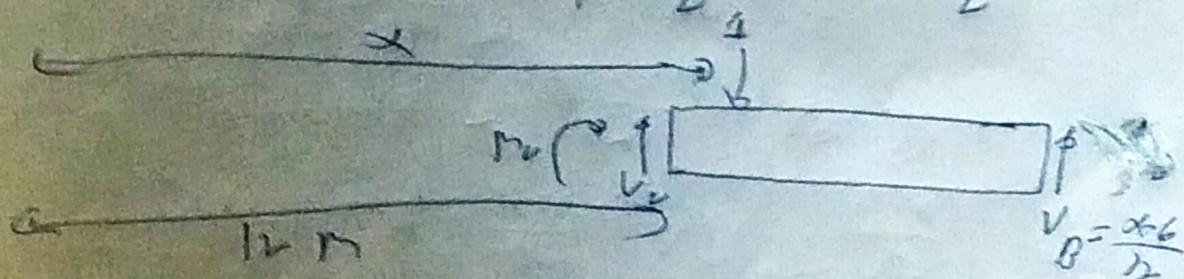
$$V_U = 1 - \frac{x-6}{12} = \frac{-x+6}{12} = \frac{6-x}{12}$$





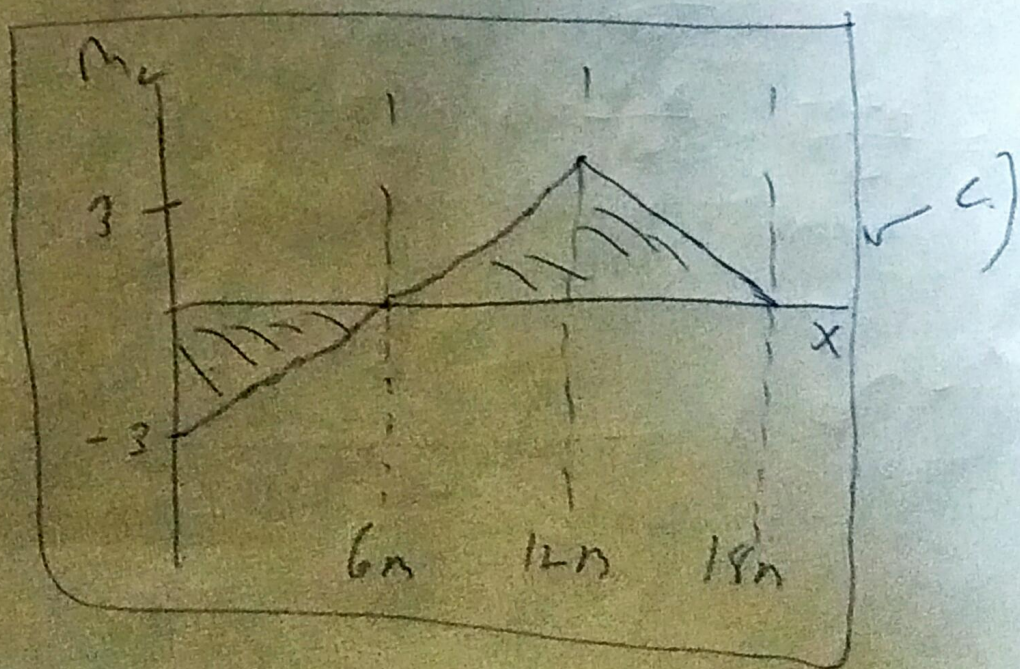
$$\sum M_c = 0 \quad -1(12-x) + \frac{18-x}{12}(6) - M_c = 0$$

$$M_c = x - 12 + 9 - \frac{x}{2} = -3 + \frac{x}{2}$$



$$\sum M_c = 0 \quad -M_c - 1(x-12) + \frac{x-6}{12}(6) = 0$$

$$M_c = 12 - x + \frac{x}{2} - 3 = 0 \Rightarrow M_c = 9 - \frac{x}{2}$$



What is the maximum negative moment C due to a concentrated live load $P = 27.5 \text{ kN}$ and a uniform live load with intensity 12 kN/m ? Show by a sketch where the loads shall be applied to obtain the maximum value.

$$M_p = 27.5(-3) = -82.5 \text{ kNm}$$

$$M_w = 12 \left(\frac{1}{2} \right) (-3)(6) = -108 \text{ kNm}$$

$$M = M_p + M_w = -190.5 \text{ kNm}$$

maximum negative moment at $C = -190.5 \text{ kNm}$

$$P = 27.5 \text{ kN}$$

$$W = 12 \text{ kN/m}$$

